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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TATSUZO ISHIDA, YUICHI HATTORI, and
YOSHIHIRO KUROKI

Appeal 2007-2635
Application 09/646,849
Technology Center 2800

Decided: December 18, 2007

Before MAHSHID D. SAADAT, SCOTT R. BOALICK, and JOHN A. JEFFERY, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

1Appellants appeal under 35 U.S.C. § 134 from the Examiner's rejection of claims 1, 3, 4, 6, 8, 9, and 11-30. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

STATEMENT OF THE CASE

Appellants invented a joint mechanism control apparatus for a two-leg walking robot. The apparatus includes an actuator with (1) electric current detection means, (2) torque detection means, and (3) control means all included in the actuator. Such an arrangement simplifies the apparatus and reduces wiring.[1] Claim 1 is illustrative:

1. A joint control apparatus for controlling the movement of a robot joint, which includes a first link and a second link where the first link is rotated about a predetermined axis with torque generated by the apparatus, said apparatus comprising:

an actuator;

electric current detection means included in said actuator for detecting a drive current of the actuator;

torque detection means included in said actuator for detecting the amount of torque based on the drive current detected by said electric detection [*sic* -- electric current detection] means; and

control means included in said actuator for controlling the actuator based on the amount of torque detected by said torque detection means.

The Examiner relies on the following prior art references to show unpatentability:

Onaga	US 4,807,153	Feb. 21, 1989
Tsai	US 5,245,263	Sep. 14, 1993
Takenaka	US 6,064,167	May 16, 2000
Villaret	US 6,222,338 B1	Apr. 24, 2001 (filed Nov. 19, 1999)

[1] *See generally* Specification 3:8 - 7:11.

Claims 1, 3, 4, 6, 8, 9, and 11-30 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Onaga, Tsai, Villaret, and Takenaka.

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Briefs[2] and the Answer for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments which Appellants could have made but did not make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

OPINION

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

Discussing the question of obviousness of a patent that claims a combination of known elements, *KSR Int'l v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), explains:

> When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* [*v. AG Pro, Inc.,* 425 U.S. 273 (1976)] and *Anderson's-Black Rock*[,

[2] We refer to the most recent Appeal Brief filed June 7, 2004 and the Reply Brief filed October 29, 2004 throughout this opinion.

> *Inc. v. Pavement Salvage Co.*, 396 U.S. 57 (1969)] are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

KSR, 127 S. Ct. at 1740. If the claimed subject matter cannot be fairly characterized as involving the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness can be based on a showing that "there was an apparent reason to combine the known elements in the fashion claimed." *Id.* at 1740-41. Such a showing requires "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *Id.* at 1741 (quoting *In re Kahn*, 441 F.3d 977, 987 (Fed. Cir. 2006)).

If the Examiner's burden is met, the burden then shifts to the Appellants to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992).

Regarding representative claim 1,[3] the Examiner's rejection essentially finds that Onaga discloses a robot device with a joint control apparatus with every claimed feature except for the actuator including a current and torque detector and control means. The Examiner cites Tsai as teaching an actuator

[3] Appellants indicate that claims 1, 3, 4, 6, 8, 9, and 11-30 stand or fall together (Br. 5). Accordingly, we select claim 1 as representative. *See* 37 C.F.R. § 41.37(c)(1)(vii).

with such features, and further cites Villaret for including torque and current detectors, along with the motor, in an actuator case. Lastly, the Examiner cites Takenaka to show that it is well known that robots comprise leg units. Based on these teachings, the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a controller for the operating joint or motor of Onaga that detected current and torque (Answer 6-7).

Appellants argue that there is no teaching or suggestion that would have motivated the skilled artisan to combine the teachings of the cited references to arrive at the claimed invention (Br. 7; Reply Br. 4). According to Appellants, the skilled artisan interested in developing a backup system to monitor the validity of a velocity feedback signal generated by servo-motors associated with robotic joints would not have been motivated to employ Tsai's unidirectional torque method (Br. 9). Appellants further argue that the servo controller and motors in Villaret are separate components and not provided together as the Examiner suggests. Furthermore, Appellants contend, Villaret's servo controller is not an actuator, but rather an electronic system that controls arm movement by controlling current supplied to the actuators (Br. 10-11).

Appellants also argue that Tsai does not disclose an actuator including current and torque detectors and a controller *within the actuator itself* as claimed. In this regard, Appellants emphasize that Onaga's control boards 400, 600, and 800 are external to the robot and not located within the actuators associated with the robot's joints (Br. 12). In addition, Appellants contend that the control devices in Tsai are not located within the actuators themselves, but are separate units located at some other portion of the robot

arm or unit (Br. 13). Regarding Villaret, Appellants reiterate that not only is the servo controller not an actuator, the servo controller and motors are separate components and not provided together (Br. 13-14).

The Examiner responds by first acknowledging that while Onaga discloses all the claimed elements, the reference does not provide all of those elements *in the actuator* as claimed. The Examiner, however, notes that Villaret teaches providing torque and current sensors in the actuator to control the same. Furthermore, the Examiner takes the position that Villaret's servo controller 31 can be considered an "actuator." In this regard, the Examiner emphasizes that Figure 3 of Villaret shows the servo controller as a block that includes the motor, encoder, and various control functions (Answer 7-8).

The issues before us, then, are (1) whether the cited prior art teaches or suggests providing electric current and torque detection means and control means *in the actuator* as claimed, and (2) whether the skilled artisan would have reasonably combined the cited references to arrive at the claimed invention. For the reasons that follow, we answer "yes" to both of these questions.

Before turning to the prior art, we first interpret the term "actuator" as claimed -- a critical limitation that forms a key aspect of the dispute before us. To this end, we first turn to Appellants' disclosure for guidance.

At the outset, we find that the Specification and the Briefs are unclear regarding exactly what structure of the disclosed invention corresponds to the claimed "actuator." Appellants' Specification does not specifically use the term "actuator" in the section entitled "Best Mode for Carrying Out the Invention" -- a substantial section that describes the invention in detail from

Pages 9-44. Nevertheless, Appellants do use the term "actuator" in the "Summary of the Invention" section on Pages 3-7 of the Specification.[4] Apart from merely generally mentioning an actuator in a manner commensurate with the claim language, however, this section does not provide any further details regarding what exactly constitutes an "actuator" as claimed.[5]

In any event, the claims themselves appear to provide the best guidance regarding what elements of the disclosed invention correspond to the claimed "actuator." Specifically, claim 3 recites that *the actuator* includes (1) a motor unit; (2) a torque amplification unit; and (3) motor control means.

Based on this recitation read in light of the disclosure, we presume that the motor structure illustrated in Figure 9 of the present application most reasonably corresponds to the claimed "actuator," at least in part. In that figure, there are three main elements which match all of the elements recited in claim 3: (1) motor unit 90, and (2) torque amplification unit 91; and (3) a motor control means (described below).

As shown in Figure 9, the motor unit comprises a motor case 92 which has various components disposed therein including, among other things, two key control components: (1) a control substrate 111, and (2) a power substrate 112. The power substrate 112, shown in more detail in

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[4] In fact, Appellants refer to this section exclusively in the "Summary of the Invention" section of the Appeal Brief. *See* Br. 2-5.

[5] In fact, the most specific description of an "actuator" in the Specification is in the "Background Art" section. In that section, Appellants indicate that a conventional two-leg walking robot "has an *actuator* (normally an AC (Alternating Current) *serve-motor* [*sic*] hereinafter referred to as a *motor*)…" (Specification 1:16-19).

Figure 18, (1) detects the level of drive current supplied to motor coils via electric current sensors 71; (2) transmits the detection results to the control substrate 11 via cable 121; and (3) supplies drive current to the motor coils under the control of control substrate 111 (Specification 21:10 - 22:8; 18:16-19; 27:14-22; 43:15-19; Figs. 9 and 18).

The control substrate 111, shown in more detail in Figure 17, comprises a one-chip microcomputer 115 that, among other things, computes the value of the drive current to be applied to the motor coils (Specification 20:19 - 21:9; Figs. 9, 17, and 19). As shown in Figure 19, the one-chip microcomputer 115 comprises an arithmetic operations block 128 that can calculate external torque applied to the output axis of the motors based on the detected drive currents (Specification 43:23 - 44:7).

Notwithstanding this description, we conclude that Appellants have not expressly or implicitly defined the term "actuator" in the disclosure so as to limit the term to structure commensurate with the embodiment described above (e.g., the actuator recited in claim 3). Indeed, claim differentiation principles alone suggest that Appellants did not intend for the "actuator" recited in claim 1 to be limited to this embodiment.[6] We therefore interpret the term "actuator" by giving the term its ordinary and customary meaning -- the meaning that the term would have to a person of ordinary skill in the art. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

[6] "The doctrine of claim differentiation creates a presumption that each claim in a patent has a different scope…The difference in meaning and scope between claims is presumed to be significant to the extent that the absence of such difference in meaning and scope would make a claim superfluous." *Free Motion Fitness, Inc. v. Cybex Intern., Inc.*, 423 F.3d 1343, 1351 (Fed. Cir. 2005) (internal quotation marks and citations omitted).

To determine the ordinary meaning of commonly understood words, it is entirely appropriate to cite a dictionary definition. *Agfa Corp. v. Creo Products, Inc.*, 451 F.3d 1366, 1376 (Fed. Cir. 2006). Accordingly, the term "actuator" is defined in pertinent part as "[o]ne that activates, especially a device responsible for actuating a mechanical device…."[7]

With this interpretation in mind, we now turn to the prior art. First, we agree with the Examiner's interpretation of Onaga with respect to the various limitations of representative claim 1 indicated on Pages 3 and 4 of the Answer. Second, Tsai in Figure 3 discloses a mechanism with two degrees of freedom with three actuators (motors). Motor 1 drives joints 1 and 2 simultaneously, motor 2 drives joint 1, and motor 3 drives joint 2 individually. The three actuators can be dc-motors, stepper motors, brushless dc-motors, or other type actuator whose torque is controlled by either a computer, a PD controller or PID controller. A computer, microprocessor, or other universal control means can control the torque controlled motors (Tsai, col. 8, l. 56 - col. 9, l. 20; col. 10, ll. 25-27; Figs. 3 and 10).

While Tsai does characterize the actuators as motors as indicated above, Figure 3 of the reference nevertheless uses the labels "Controller & Motor" for these devices. Although it is unclear from Tsai what the actual structural arrangement of the controller is with respect to the motors, this characterization nevertheless suggests that the motors and controllers in Tsai are, at a minimum, functionally related and cooperate in such a manner so as

[7] The American Heritage Dictionary of the English Language, 4th Ed., 2000, *available at* http://www.bartleby.com/61/27/A0072700.html (last visited Dec. 6, 2007).

to be collectively considered as "actuators" when giving the term its broadest reasonable interpretation.

Villaret discloses a robot control system with a Main Controller 30 and a servo controller (SC) 31 which transmits torque and position values to the main controller. The SC receives command positions from the Main Controller as well as inputs from encoders 36. The SC also outputs current values to the motors (Villaret, col. 6, ll. 15-24; Fig. 2).

In Figure 3, Villaret discloses a block diagram illustrating the relationship between the Main Controller and the SC and the Manual Teaching Operation Controller (MTOC) (Villaret, col. 6, ll. 44-51; Fig. 3). As Figure 3 illustrates, the main and servo controller is shown as a single block 31. This block encompasses not only the motor and encoder, but also various control functions.

Although we find the Examiner's characterization of this grouping in Villaret as suggesting that these elements are all "in one case or part" problematic, we nevertheless agree with the Examiner that these elements can collectively be considered an "actuator" when giving the term its broadest reasonable interpretation -- an interpretation that fully comports with the ordinary and customary meaning of the term we noted previously. In that sense, the "actuator" would constitute the collection of components responsible for actuating the device. Therefore, any individual components within that collection could reasonably be considered to be "in the actuator" as claimed.

To be sure, Villaret defines the term "actuator" in the reference as an *electrical motor* which can cause relative motion of two arms, generally about the pivot joining them (Villaret, col. 2, ll. 36-38). Villaret also defines

an SC in a way that suggests that it is distinct from an actuator, namely as an electronic system that controls the movements of the arms by controlling the current supplied *to the actuators* (Villaret, col. 3, ll. 52-55).[8]

Nevertheless, the broadest reasonable interpretation of the term "actuator" is simply not limited to these descriptions in Villaret. Given the ordinary and customary meaning of the term "actuator," and absent any further guidance of the meaning of the term in the present disclosure, we conclude that the Examiner's broader interpretation of "actuator" is reasonable.

Accordingly, we find that Appellants have not shown error in the Examiner's prima facie case of obviousness based on the collective teachings of the cited references. The Examiner has reasonably interpreted the term "actuator" broadly. In view of this interpretation, taking into account the teachings of Tsai and Villaret, we conclude that the electric current detection means, torque detection means, and control means of Onaga could reasonably be included collectively within an "actuator" giving the term its broadest reasonable interpretation.

Furthermore, we conclude that the skilled artisan would have ample reason to combine the various teachings of the references. Specifically, in modifying Onaga, we see no reason why the skilled artisan would not refer to the teachings of Tsai which pertains to a robotic mechanism generally. These teachings would have been readily applicable to a wide variety of mechanisms including those disclosed by Onaga. Likewise, Villaret's control system also pertains to robotic mechanisms and its teachings would have been reasonably combinable with the other cited references.

[8] *See also* Villaret, at col. 4, ll. 27-29 (noting that the actuators are controlled by the SC).

The Examiner's obviousness rejection of representative claim 1 is therefore sustained based on the collective teachings of the references.[9] Likewise, we will sustain the Examiner's rejection of claims 3, 4, 6, 8, 9, and 11-30 which fall with claim 1.

DECISION

We have sustained the Examiner's rejection with respect to all claims on appeal. Therefore, the Examiner's decision rejecting claims 1, 3, 4, 6, 8, 9, and 11-30 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

[9] Although we find that the Examiner's reliance on Takenaka is not germane to the limitations of representative claim 1, we may nonetheless rely on fewer references than the Examiner in affirming a multiple-reference rejection under 35 U.S.C. § 103. *In re Bush,* 296 F.2d 491, 496 (CCPA 1961); *In re Boyer*, 363 F.2d 455, 458 n.2 (CCPA 1966).

AFFIRMED

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